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ELECTRICAL DEVICE CONNECTOR

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ELECTRICAL DEVICE CONNECTOR

BACKGROUND

Card edge connectors may be used to hold electrical modules such as Dual In-Line Memory Modules and to electrically couple such modules to a bus. A vertical card edge connector holds an electrical module in a vertical position. Vertical card edge connectors are unsuitable for some small form factor applications because the total height of the connector/module combination exceeds the applications' specifications.

An angled card connector may be used to reduce the height of the connector/module combination. More specifically, an angled card edge connector may hold an electrical module at an acute angle with respect to the surface on which the connector is mounted. Therefore, for a given electrical module, a height of a connector/module combination will be less if an angled card edge connector is used than if a vertical card edge connector is used. Conventional angled card edge connectors may, however, fail to provide suitable signaling between a bus and an electrical module in some applications.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cutaway view of a device according to some embodiments.

FIG. 2 is a plan view of a dual in-line memory module.

FIG. 3 is a side view of a system according to some embodiments.

FIG. 4 is a block diagram of a system according to some embodiments.

FIG. 5 is a front elevation of a system according to some embodiments.

DETAILED DESCRIPTION

FIG. 1 is a cutaway view of connector 10 according to some embodiments. Connector 10 may be used to hold an electrical module and to electrically couple the electrical module to a bus. Connector 10 may also hold the electrical module at an angle, which may reduce a total height of the connector/module combination in comparison to a connector/module combination in which the module is held vertically.

Connector 10 includes receptacle 15 and base 20. Receptacle 15 and base 20 may be coupled using any suitable coupling. In one example, receptacle 15 and base 20 are integrally formed from a single mold. Receptacle 15 defines opening 16 in which an electrical module may be received. Base 20 includes lower surface 21. Lower surface 21 may form an acute angle (e.g. 25 degrees) with an electrical module received in opening 16.

Connector 10 also includes contacts 30, 40, 50 and 60. Contacts 30, 40, 50 and 60 may be used to electrically couple an electrical module received in opening 16 to one or more signal lines. Contacts 30, 40, 50 and 60 may comprise phos-bronze or brass according to some embodiments.

Contacts 30 and 40 are adjacent to each other in the illustrated embodiment. As shown, portion 31 of contact 30 protrudes from lower surface 21 and portion 32 of contact 30 protrudes from receptacle 15 into opening 16. Similarly, portion 41 of contact 40 protrudes from lower surface 21 and portion 42 of contact 40 protrudes from receptacle 15 into opening 16.

Portions 31 and 41 may comprise a pin, a solder bump, and/or or any other element to electrically couple contacts 30 and 40, respectively, to an external signal line. In specific examples, portions 31 and 41 comprise tin or tin/lead-plated phos-bronze. Portions 32 and 42 may comprise a pad, a bare wire, a coated wire and/or another element to electrically couple contacts 30 and 40, respectively, to an electrical circuit of an electrical module received in opening 16. Portions 32 and 42 comprise phos-bronze with gold plating and nickel underplating according to some embodiments.

Portions 32 and 42 may couple contacts 30 and 40 to an electrical module by contacting connection pads of the electrical module. FIG. 2 is a view of an electrical module that may be used in conjunction with some embodiments. Module 70 is a Double Data Rate Dual In-Line Memory Module (DIMM) which includes integrated circuits 72, connection pads 74 and mounting structures 76. Although FIG. 2 illustrates only one side of module 70, the unshown side also includes additional connection pads 74 and may include additional integrated circuits 72.

Portions 32 and 42 therefore contact respective ones of connection pads 74 in a case that module 70 is received in opening 16. The respective ones of connection pads 74 may be adjacent to one another on module 70. Receptacle 15 may include structures corresponding to mounting structures 76 to enable a secure physical connection between receptacle 15 and module 70. Other types of electrical modules which differ in electrical function, physical configuration or otherwise from module 70 may be used in conjunction with some embodiments. As non-exhaustive examples, module 70 may be a Double Data Rate DIMM with a different physical configuration, a Single Data Rate or a Quad Data Rate DIMM with a same or different physical configuration, another type of memory module such as a Single In-Line Memory Module (SIMM), and/or a module having a same or different physical configuration that provides a function other than memory storage.

According to some embodiments, contact 30 and contact 40 are of substantially the same length. In some embodiments, a distance between portion 31 and portion 32 is substantially equal to a distance between portion 41 and 42. The substantially equal distances may reduce signal skew of signals carried by contacts 30 and 40 to respective ones of connection pads 74 in comparison to conventional systems.

As described above with respect to contacts 30 and 40, contacts 50 and 60 are adjacent to each other. Portion 51 of contact 50 protrudes from lower surface 21 and portion 61 of contact 60 protrudes from lower surface 21. Portions 51, 52, 61 and 62 may comprise any of the alternatives mentioned above with respect to corresponding portions 31, 32, 41 and 42.

However, portions 52 and 62 of contacts 50 and 60 protrude from a side of receptacle 15 that is different from the side of receptacle 15 from which contacts 30 and 40 protrude. Accordingly, portions 52 and 62 are to contact connection pads 74 that are disposed on a different side of module 70 than connection pads 74 with which portions 32 and 42 are to make contact.

Contact 50 and contact 60 may be of substantially the same length. The length may be different from or substantially equal to the length of contacts 30 and 40. According to some embodiments, a distance between portion 51 and portion 52 may be substantially equal to a distance between portion 61 and 62. Again, these substantially equal distances may reduce signal skew of signals carried by contacts 50 and 60 to module 70 in comparison to conventional systems.

FIG. 3 illustrates a system according to some embodiments. The FIG. 3 system comprises several instances of connector 10, each of which includes an instance of opening 16 (not shown) which receives a respective instance of module 70. Each instance of connector 10 is mounted on substrate 80. Substrate 80 may comprise a motherboard substrate for a computing device such as a server. Also mounted on substrate is memory controller 90, which may provide a microprocessor (not shown) with access to memory storage provided by modules 70. In this regard, memory controller 90 is coupled to bus 95 which is in turn coupled to each of connectors 10. Bus 95 may comprise a parallel memory bus, a serial memory bus, or any other bus.

Bus 95 may comprise individual signal lines, each of which is coupled to one portion of a contact protruding from one of connectors 10. According to such an arrangement, each signal line may be connected to one connection pad of each module 70. Connectors 10 may be coupled to bus 95 and to substrate 80 by soldering contact portions protruding from each connector 10 directly to bus 95. In another example, pins protruding from each connector 10 may be inserted into sockets that are mounted on substrate 80 and electrically connected to bus 95.

FIG. 4 is a block diagram of system 100 according to some embodiments. System 100 may comprise a hardware server packaged within a thin enclosure, and therefore referred to as a blade server. System 100 includes previously-described substrate 80 and memory controller 90 mounted thereon. Also included are connector/memory module combinations 103 coupled to memory controller 90. Connector/memory module combinations 103 may comprise the combinations of connector 10 and module 70 shown in FIG. 3.

Memory controller 90 is coupled to processors 101 and 102, such as Intel Xeon™ processors. Memory controller 90 may therefore provide processors 101 and 102 with access to memory storage provided by combinations 103. Software applications may be stored for extended periods in hard disk drives 104 and 105. Also stored in hard disk drives 104 and 105 may be data files, device drivers, and an operating system for controlling basic functions of system 100.

Ethernet controller 106 allows system 100 to communicate with other devices via Ethernet protocol. Similarly, USB controller 107 provides communication with USB devices. The USB devices and other devices may be coupled to system 100 using backplane interface 108.

FIG. 5 is a view of a system according to some embodiments. As shown in FIG. 5, system 110 comprises chassis 120 in which are mounted blade servers 131, 132, 133, 134, and 135, which are each similar to system 100 of FIG. 4. Blade servers 131, 132, 133, 134, and 135 are coupled via respective backplane interfaces to a midplane, which is a type of backplane that is located within chassis 120.

Chassis 120 may be coupled to one floppy disk drive, one compact disc drive, one keyboard and one mouse via respective Universal Serial Bus interfaces. Blade servers 131, 132, 133, 134, and 135 therefore share these peripheral devices amongst themselves. Chassis 120 may also includes a management module, which receives requests to access the peripheral devices from the other blade servers.

The several embodiments described herein are solely for the purpose of illustration. Embodiments may include any currently or hereafter-known elements that provide

functionality similar to those described above. Therefore, persons skilled in the art will recognize from this description that other embodiments may be practiced with various modifications and alterations.